STATE & PRIVATE FORESTRY
FOREST HEALTH PROTECTION
SOUTH SIERRA SHARED SERVICE AREA

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Subject: Pandora Moth concerns in Three Creeks Jeffrey Pine Forest Health and Restoration Project North Zone, Inyo National Forest

Introduction

The Pandora moth (*Coloradia pandora*) is a native defoliator of several pines throughout western forests, except Idaho and Washington (Furniss and Carolin 1992). It feeds primarily on ponderosa and Jeffrey pine in California – preferably in mature stands, but will also feed on lodgepole, sugar, and coulter pines. On eastside forests of Sierra Nevada, Pandora moth larvae feed heavily on Jeffrey pines: completely stripping trees of older needles, sometimes causing direct mortality. By the end of the season affected tree crowns look red and very thin.

Pandora moth is a large moth, grayish in color, and hairy bodied. Wingspan ranges from 70-110 mm, with a distinctive dark spot on fore and hind wings right in the middle. Adults fly during the summer season, starting in June through July. Eggs are laid in clusters on the needles or the bark, with larvae emerging in late August through September. Larvae feed until temperatures drop, overwinter, then re-merge around April (in California) to resume feeding. By June, most larvae are full grown, descend into soil at the base of host trees, and burrow deep to safely transform complete their lifecycle (Carolin and Knopf 1968). This last stage typically takes one year for full development to adult, but some can remain up to 5 years in diapause (Furniss and Carolin 1992).

Outbreaks of this insect occur infrequently but have devastating effects when they do. Several notable outbreaks in the past decade in Colorado, Oregon, Arizona, and northern California were affected up to several thousand acres. While epidemics of this insect do not necessarily equate to dead trees, larvae counts and needle injury debilitate tree growth and vigor. Secondary infestation by bark beetles on damaged trees increase after severe defoliation. Tree mortality also seems higher in areas with heavy dwarf mistletoe infestation (Wagner and Mathiasen 1985). Due to the two year development period required for this insect, epidemics have lasted up to 10 years. Populations appear to be controlled by naturally occurring viruses that are also found in other Lepidoptera species. Viral infection levels appear to increase as populations increase, following standard courses of predator-prey relationships.

The most recent recording of large populations of Pandora moth began in 2002 in Inyo County, tapering by the summer of 2005 (California Forest Pest Conditions 2002 through 2005). Three years is very short in duration, compared with 6 to 8 years with previous outbreaks. No mortality was observed, despite the prevalence of adults in Mammoth Lake, and

defoliation noted in scattered pockets Jeffrey pine stands. At the height of the outbreak, over 40,000 acres were detected with light to moderate defoliation; the heaviest defoliation occurring by Lookout Mountain, and south and east of Dry Creek. Heightening sightings of Pandora moth were also visible in other parts of the state around that time: Laguna Mountains (San Diego County), and in 2006, around southern portions of Lake Tahoe (El Dorado County). Very minimal defoliation was noted despite finding ubiquitous larvae on pine hosts.

Discussion of Proposed Management Alternatives for Three Creeks Project

There appears no specific trigger that causes populations to suddenly increase rather outbreaks occur in 20 to 30 year intervals in similar locations. The burrowing pupae phase of this insect requires loose pumice soils or decomposed granite, thereby recurrent activity in the volcanic soils of Inyo National Forest are not surprising. No apparent stand conditions such as basal areas or host composition, or site conditions like aspect or slope contribute to where high populations will occur. Thinning during outbreaks did not affect damage severities, densities of egg or larvae, or reduce the outbreak duration (Ross 1995). Schmid and Bennett (1988) found that directed manipulations in stand structure or host size did not affect insect oviposition or larval preference. They suggested general silvicultural treatments that improve tree vigor and growth, as well as reducing incidence of dwarf mistletoe would be beneficial to creating host resilience if outbreaks should occur (Schmid and Bennett 1988). However, activity that disturbs soils at bases of host trees would surely disrupt development of any pupae present, but would not significantly affect overall populations.

Prescribed fire and natural wildfires have occurred in the forest for centuries and Pandora moths have evolved with these disturbances. Prescribed fire has been used as a control measure during outbreaks to reduce population of Pandora moth. One study ran a low intensity back burn during the diapause year when larvae were pupating underground (Schmid et al. 1981). Significant mortality only occurred where litter depth was thick enough to keep burning, while sparse litter had no mortality. Another study utilized adult Pandora nighttime attraction to lights, trying to draw them towards nocturnal prescribed burns (Gerson and Kelsey 1997). This also proved a failed endeavor as limited mortality was noted; however, moths were quite attracted to fire color spectrums, not deterred by radiant heat. In the Sierra Nevada frequent occurring wildfires helped keep surface fuel loads down and created more open stands; in contrast, fire suppression management in the past century has resulted in dense forests and high fuel loading. Prescribed fire treatments – typically burning at low to moderate intensities, would affect local populations but only to very limited degrees. Current wildfires are burning at much higher intensities that moth populations would most likely be affected by these severe events rather than low impact directed disturbances.

If there are further questions regarding Pandora Moth biology or concerns regarding this report, please do not hesitate to contact us.

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